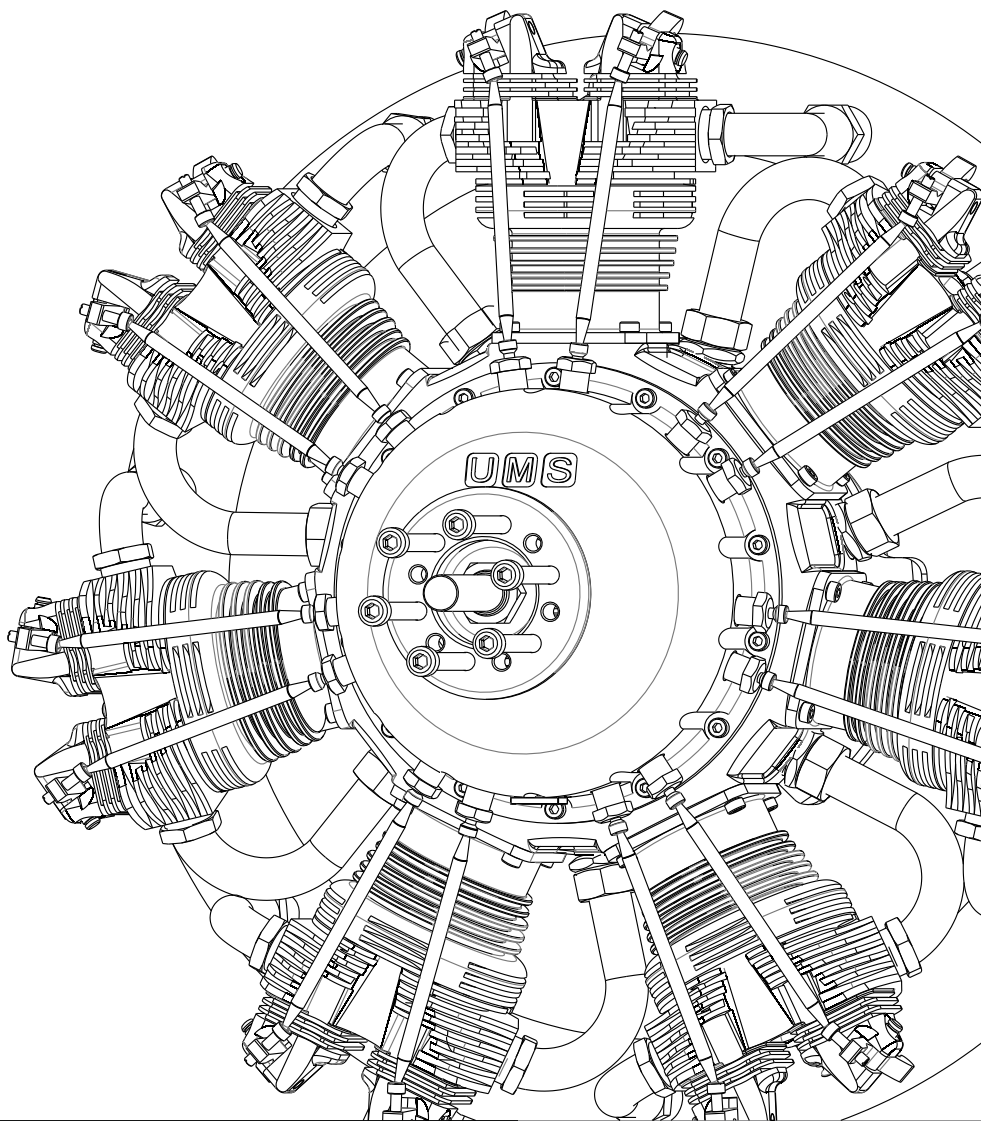


UMS Technologies Limited

User Manual For Gas Radial Engines



NOTICE

All instructions, warranties and other collateral documents are subject to change at the sole discretion of UMS, Inc. For up-to-date product literature, and click on the support tab for this product.

Meaning of Special Language

The following terms are used throughout the product literature to indicate various levels of potential harm when operating this product:

NOTICE: Procedures, which if not properly followed, create a possibility of physical property damage AND a little or no possibility of injury.

CAUTION: Procedures, which if not properly followed, create the probability of physical property damage AND a possibility of serious injury.

WARNING: Procedures, which if not properly followed, create the probability of property damage, collateral damage, serious injury or death OR create a high probability of superficial injury.

WARNING: Read the ENTIRE instruction manual to become familiar with the features of the product before operating. Failure to operate the product correctly can result in damage to the product, personal property and cause serious injury.



This is a sophisticated hobby product and NOT a toy. It must be operated with caution and common sense and requires some basic mechanical ability. Failure to operate this Product in a safe and responsible manner could result in injury or damage to the product or other property. This product is not intended for use by children without direct adult supervision. Do not attempt disassembly, use with incompatible components or augment product in any way without the approval of UMS, Inc. This manual contains instructions for safety, operation and maintenance. It is essential to read and follow all the instructions and warnings in the manual, prior to assembly, setup or use, in order to operate correctly and avoid damage or serious injury.

CAUTION: This product can become extremely hot when in use, which could lead to burns.



Age Recommendation:

Not for children under 14 years. This is not a toy.

Safety Warnings

Model engines produce a substantial amount of power, which can create unsafe situations if not used correctly. Always use common sense and observe all safety precautions when operating, handling or performing any procedure involving your engine. Failure to follow safety precautions could result in serious injury and property damage.

- Always ensure spectators, especially children, are at least 30 feet away when running the engine.
- Always ensure that the propeller is securely attached to the engine shaft and all retaining fasteners are tightened properly before EACH flight. Use of blue threadlock to tighten nuts is advisable.
- Always keep small parts out of the reach of children as they can be choking hazards.
- Always secure the airplane before powering the engine.
- Always keep your face and body away from the path of the propeller blades when starting or running your engine.
- Always stand behind the propeller when making carburetor adjustments.
- Always wear safety glasses or goggles when starting and running your engine.
- Always keep your fuel in a safe place away from sparks, heat or anything that can ignite.
- Always ensure the aircraft is secure and will not move once the engine is started.
- Always rebind your transmitter to your receiver(s) after setup and before first flight.
- Always ensure the throttle failsafe is set to low throttle in your transmitter.
- Always perform a range check prior to flight.
- Always cut off the fuel supply (pinch or disconnect the fuel line to the carburetor) or use the throttle linkage to shut off the air in order to stop the engine.
- Never use hands, fingers, or any other body part to stop the propeller.
- Never throw any object into a propeller to stop it.
- Never run the engine in the vicinity of loose small objects, such as gravel or sand, to avoid the propeller uncontrollably throwing such materials.
- Never wear loose clothing or a loose neckstrap when operating your model engine as these items could become entangled in the propeller.
- Never have loose objects such as screwdrivers, pencils, etc. in your pockets when operating your model engine. These could fall into the propeller.
- Never allow fuel to come into contact with eyes or mouth. Gasoline and other fuels used in model engines are poisonous.
- Always ensure gasoline and fuel are stored in a clearly marked container away from the reach of children.

Precautionary Guidelines

- Always mount the engine securely on a bench mount or high-quality engine mount.
- Always use the correct size and pitch of propeller for your engine. Refer to the Propeller Chart in this manual.
- Always confirm proper balance of your propeller prior to installation of the engine. Failure to do so could result in damage to the engine and/or airframe.
- Always utilize an electric starter to start your engine.
- Always discard any propeller that is nicked, scratched, cracked or damaged in any way.
- Always run your model engine in a well-ventilated area. Model engines can produce possibly harmful carbon monoxide fumes.
- Always store your fuel safely in a sealed, water-resistant container.
- Always store fuel in a cool, dry location. Do not allow fuel containers to come in direct contact with concrete, as the fuel may absorb moisture.
- Always responsibly discard fuel if there is condensation and/or water inside the fuel container.
- Never return unused fuel from the fuel tank back into the fuel container.
- Never attempt to repair or modify a propeller beyond its intended use.
- Never handle model engines, mufflers and/or tuned pipes until they have had time to cool. They can become extremely hot when in use.

Introduction

Thank you for purchasing an UMS radial engine, one of the finest engines in the market place today. UMS is committed to you having a positive experience and a lifetime of great operation with your new engine.

It is important that you read the engine manual before starting the engine for the first time.

UMS radial engines have different requirements than engines that you may have operated in the past. The manual provides important information for installing the engine, selecting the correct propeller, fuel requirements and proper engine break-in procedures.

Engine Specifications

Engine	7-160 cc
Type	4 - Stroke Petrol
Displacement	160.0 cc
Bore	30.2 mm
Stroke	32.0 mm
Cylinders	7
Total Weight	4.8 Kg with Ignition Coil
RPM Range	1100 - 6000
Fuel	Petrol with 1:32 Two Stroke oil
Engine Dia & Length	29.0 cm & 26.0 cm
Muffler Type	Collector Ring
HP	10.6
Cylinder Type	ABC
Carb Type	WT 621
Propellers Range	2-Blade: 27x10, 27x12, 28x10, 28x12 3-Blade: 26x12

Needed to Complete

- 2-stroke oil
- Propeller
- Fuel line (3.5mm ID)
- Engine mounting screws
- Engine baffles
- Electronic ignition battery (2S 7.4V Li-Po or 6V Ni-MH)
- Electronic ignition switch

Installing the Engine in the Airframe

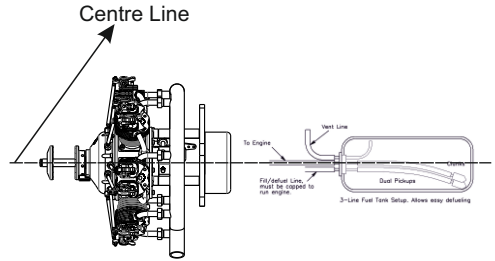
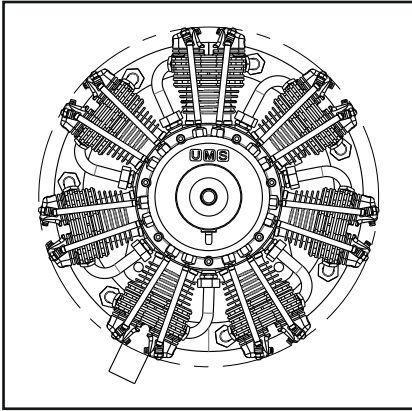
Properly installing the engine to either the airframe or an engine test stand for break-in is crucial to getting the most power and longest life from your engine.

WARNING: Always attach the engine mounting ring to a flat plate surface, such as 6–8mm plywood or carbon fiber plate.



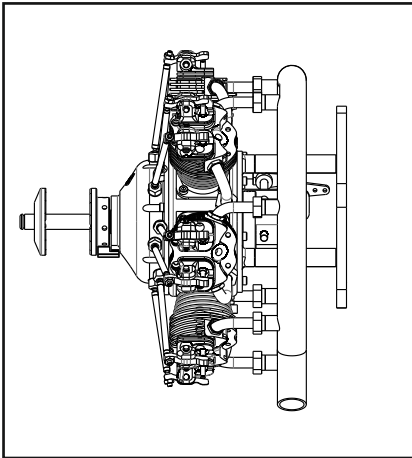
WARNING: Never use a standoff between the firewall and the mounting ring. Vibration between the standoff and the mounting ring will damage the mounting ring and cause the engine to separate from the airframe.





Note : Install the tank on the centre line of the engine

1. Install the engine on the airframe with Cylinder #1 in the top (12:00) position (Cylinder #1 is above the UMS Engines logo).



2. Use three steel screws (not included) to attach the engine mounting ring to the firewall. The size of the mounting ring screws will vary depending on the aircraft. Always use the largest size screw that will fit through the mounting ring.

To keep the engine from coming loose in flight:

Firewall with blind nuts installed: Always use split washers between the mounting ring screws and the mounting ring.

Firewall with through bolts installed: Always use nylon locking nuts with bolts through the firewall.

3. Make sure the fuel tank is no farther than 200mm (8 in) from the back of the firewall.
 - Always use a fuel filter inside the fuel tank.
 - We recommend using large (2.5mm) inner diameter fuel line.
 - Make sure there are no sharp bends in the fuel line between the fuel tank and the engine.
4. Attach the throttle servo linkage to the throttle bellcrank on the engine.
5. Add your choice of activation mechanism (servo operated pushrod) for the choke lever.

Installing the Electronic Ignition

NOTICE: Always observe proper polarity when connecting the ignition battery to the ignition unit. The ignition unit does not include reverse polarity protection. Ignition unit damage caused by reverse polarity is not covered under warranty.

An electronic ignition is included with your engine. The spark plug wires are labeled for each cylinder—ensure the spark plug wires are connected to the correct cylinders. Connecting the spark plug wires to the incorrect cylinders will change the firing order and the engine will not run correctly.

The electronic ignition requires a 6—7.4V 2500mAh battery. For the best performance, we recommend a 7.4V 2S Li-Po battery (minimum 2500mAh) and a suitable switch (JRPA001). A voltage regulator is not required for use with a 7.4V 2S Li-Po battery.

Engine Cooling Requirements

It is very important to consider adequate cooling inside the airplane cowl. Engines require a cooling airflow exhaust:intake ratio of 3:1 to 5:1. A large open cowl may lead you to believe there is adequate cooling; however, you must make sure air is flowing through the cowl and the cylinder head fins. Achieving the proper ratio typically requires cowl and/or engine baffles to reduce the open intake area.

1. Ensure there is adequate cooling air moving through the cylinder head cooling fins.
The intake air tends to move through the path of least resistance (between the cylinders) instead of through the cylinder cooling fins.
2. If necessary, add baffles to the engine to prevent air from moving between the cylinders.
Engine baffles force cool air through the cooling fins and greatly reduce the intake area in the front of the cowl.
3. Add cooling baffles to the engine cowl between the top of the cylinder heads and the inside of the cowl.
4. Do not cover the engine exhaust tube with the baffle. The exhaust tube requires direct air cooling to prevent damage to the exhaust valve.

Propeller Selection

Propeller selection is critical for proper engine operation. You can find recommended propellers and operating RPM ranges in the specification chart. UMS radial engines have a lower operating RPM range and greater torque within that range that require more blade pitch and increased in-air pitch speed for your airplane.

To increase climbing and acceleration: Increase propeller diameter and decrease blade pitch.

To increase top speed: Decrease propeller diameter and increase blade pitch.

Make sure the propeller is securely mounted to the crankshaft before attempting to start the engine.

1. Remove the Allen bolt from the propeller washer.
2. Install the propeller on the crankshaft.
3. Secure the propeller with the six allen bolt

Fuel Selection

	Break-in Fuel	Normal Flying Fuel
gasoline:2-stroke oil	32:1	40:1

Engine Break-In Process

A good break-in process is essential to the longevity and performance of your UMS radial engine. You can complete the break-in process by either mounting the engine on a test stand or on an airframe. If you choose to mount the engine on an airframe, remove the cowl during break-in to ensure adequate cooling.

Specific fuel is required for the break-in process. Please refer to the chart above for the proper fuel. Break-in fuel contains additional oil compared to fuel you will use for everyday flying. The additional oil is critical for cooling and removing break-in debris from the engine.

Run the engine through four tanks of fuel (32 oz/1000mL) for 3—4 minutes at a time, allowing the engine to cool between runs. Vary the throttle between idle and $\frac{3}{4}$ throttle for the first 30 minutes of engine run time. Do not exceed $\frac{3}{4}$ throttle during the break-in. The engine break-in process is complete after the first four tanks of fuel and you can begin tuning the engine for normal flying.

Checking for a Flooded Cylinder

Because of the nature of radial engines, it is not uncommon for the lower cylinders to accumulate excess fuel or oil either in storage or during the priming process. Before beginning the starting process be sure to:

1. Rotate the propeller by hand. During the rotation, if you encounter a point where there is serious resistance to the rotation, STOP. This is an indication of a flooded cylinder and what you are feeling is hydraulic lock. Any further attempts to force the rotation of the engine can result in damage to the cylinder or conrod.
2. If you encountered hydraulic lock, remove the spark plug from the lower two cylinders and the engine should rotate freely. Continue to rotate until all the excess fluid has been removed from the cylinder.
3. Reinstall the spark plug and continue with the starting process.

Starting the Engine

Use a high quality gear oil to lubricate the outer parts of the valve train at the beginning of each flying day.

1. Fill the fuel tank with fuel.
2. Make sure the fuel lines are properly connected to the carburetor.
3. Switch off ignition, turn the propeller with closed choke flap until the fuel reaches the carburetor
4. Switch on ignition and holding the propeller firmly, turns the propeller 2-3 full times to such fuel into the engine.
5. Now with firm flick, try and start the engine.
6. Engine run approx. at 1000 rpm for two minutes to warmup

Engine Tuning

The break-in settings for the carburetor needles are:

High-speed needle: 2 turns open

Low-speed needle: 1 1/4 turns open

Use a tachometer to tune the engine based on RPM.

WARNING: Always adjust the carburetor from behind the propeller. Keep all loose items away from the propeller at all times. Never reach over or around the propeller.



1. Start the engine.
2. Move the throttle stick up until the engine is running at approximately 2,000 rpm.
3. If you are using separate exhaust pipes, use a temperature gun to make sure hot exhaust is exiting all engine cylinders. If you are using a collector ring, use a temperature gun to make sure all the cylinder temperatures are similar and firing smoothly.
4. Move the throttle stick up to full (open) throttle. If the engine runs rough or if some cylinders are not operating, the fuel mixture is too rich.
5. Lower the throttle stick until the engine reaches 2,000 rpm. Lean the high-speed needle (turn clockwise) 1/16 turn.
6. Quickly raise the throttle stick to full (open) throttle. If the engine stops running, the high-speed needle setting is too lean.
7. Lower the throttle stick until the engine reaches 2,000 rpm. Richen the high-speed needle (turn counterclockwise) 1/8 turn.
8. Repeat Steps 4–7 until the engine is running reliably at full (open) throttle.

High-Speed Needle Tuning

Once the engine is running reliably at full (open) throttle:

1. Lean the high-speed needle 1/16 of a turn at a time.
 2. Wait 2–3 seconds for the engine to respond. Radial engines do not respond immediately to tuning changes.
 - a. If there is an increase in RPM: Lean the high-speed needle an additional 1/16 turn and wait for the engine to respond to the tuning change. If there is no increase in RPM after the change, turn the high-speed needle back to its previous position.
 - b. If there is a decrease in RPM: Richen the high-speed needle 1/8 turn and wait for the engine RPM to stabilize.
 3. Repeat Step 2 until you determine the maximum RPM with the fuel and propeller you selected.
 4. Richen the high-speed needle so when full throttle is applied, the engine rpm will be steady (not drop off) after reaching its peak RPM. Richening the high-speed needle allows the RPM to increase when the airplane is flying.

Low-Speed Needle Adjustment

Low-speed needle adjustment controls the fuel/air mixture at idle and the quality of the transition between idle and wide open throttle.

Low-Speed Needle Tuning

1. Adjust the high - speed needle for the current conditions.
2. Allow the engine to idle for 10–15 seconds. Rapidly advance the throttle from idle to full open.
If the engine transitions with no hesitation, the low-speed needle is adjusted perfectly.
If the engine slowly responds to throttle change and gradually reaches peak RPM, the low-speed needle is too rich. Lean out the low-speed needle (turn clockwise) 1/16 turn and test again.
If the engine immediately stops running, the low-speed needle is lean. Richen the low-speed needle 1/16 turn and test again.
3. When the low-speed needle is adjusted correctly, check the high-speed needle setting again.
4. When you are satisfied with the needle settings, you should not need to adjust the low-speed needle again. The low-speed needle setting is mechanically controlled and does not change with atmospheric conditions.

The best indication that your engine is tuned properly is the color of your spark plugs when removed from the cylinder. A nice dry tan color is an indicator that the fuel mixture is correct and burning well. Anything else (wet plugs, or carbon deposits) generally indicates you are running the engine too rich.

Maintenance

There are a few things you must do to ensure proper operation of your UMS radial engine.

1. Use a high quality gear oil to lubricate the outer parts of the valve train at the beginning of each flying day.
2. Occasionally, you will need to adjust the valves. Adjust the valves the first time after one hour of engine run time. After the first hour, monitor the valve lash and adjust the valves as needed. Adjust the valves when the engine is cool. The lash is set at 0.05mm–0.08mm at the factory.

Radial Valve Adjustment Guidelines

1. Place the engine in a position (on or off your airplane) that allows you easy access to the valves on all the cylinders.
2. Remove the spark plugs from all the cylinders. It is much easier to determine Top Dead Center (TDC) without the compression caused by installed spark plugs.
3. Attach a propeller or other turning device (such as a short block of wood with the appropriate hole for the crankshaft) to the crankshaft and tighten it so you can easily rotate the crankshaft throughout this process.
4. Start with the number 1 cylinder (this should be the upright cylinder above the Tomahawk logo).
 - a. Rotate the crankshaft counter-clockwise and observe the pushrod movement.
 - b. Note when you see the exhaust and then the intake pushrod move up to open the valves. This will occur during one rotation of the crankshaft.
 - c. When the piston reaches the top of the cylinder during the next rotation, you are at the TDC of the compression/firing stroke.
 - d. Position the piston at TDC of the compression/firing stroke. It is helpful to place a short piece of wooden dowel. (Don't use steel, as you can mar the inner surface of the cylinder.)
5. Use a feeler gauge to check the valve lash between the rocker arm and the top of the valve.
 - a. We recommend setting the valve lash as close to 0.1mm as possible. If the valve lash is between 0.05 and 0.08mm you do not need to adjust the valve lash. The settings for the intake and exhaust valves are the same.
 - b. If adjustment is needed, adjust the valves by loosening the locking nut and adjusting the screw until you can just feel the drag of the 0.05 feeler gauge as you pull it between the valve and rocker arm.
 - c. Tighten the locking nut and recheck the valve clearance. Sometimes when tightening the nut the adjustment will change slightly.
6. Because the cam gear of our engines is a shared cam gear with all the cylinders and rotates at a 1:6 & 1:8 ratio, there are actually 6 & 8 different positions on the cam gear that need to be checked. Repeat step 6 & 8 above four more times to check each of these positions, rotating the crankshaft 6 & 8 full revolutions between each check. If you find that the valve lash is smaller, then readjust that valve. If it is greater, do not readjust the valve. A little loose is safer than too tight. (Note : 1:8 for 9-115cc)
7. Now move onto the next cylinder in a counter-clockwise direction and repeat steps 4 through 5. Do this for all 7 & 9 cylinders.

Congratulations. You have now completed the valve adjustment process. This maintenance should not be required again for another 10 hours of running time.

Notes

Notes

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